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COMMONWEALTH PHYTOPATHOLOGICAL NEWS

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PLANT BACTERIOLOGY AT C.M.I.

by A.C. Hayward
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Recent articles in this series on bacterial plant pathogens have described some important aspects of the study of a group of organisms which have not been studied as thoroughly as bacteria affecting man and animals.

Bacterial pathogens of economic plants in tropical territories are among the most destructive and the cause of ever-recurring serious crop losses. At the present time the spread of the Moko disease of bananas, for example, is causing considerable concern in parts of Central America, South America, and the Caribbean, whilst the pathogen Pseudomonas solanacearum is certainly the most widespread and perhaps the most important bacterial pathogen in tropical and warm temperate zones. In addition to banana many solanaceous and other hosts are susceptible, including potato, tomato, tobacco and related plants, groundnuts, and many other food crops (Kelman, 1953). In several laboratories work is now being carried out on the differentiation of the solanaceous and musaceous strains of P. solanacearum.

Many more pathogens of economic importance remain to be discovered and described, particularly in the remoter tropical areas where the specialised facilities for identification of bacteria are unavailable. It is imperative that where new strains or species are suspected detailed examination should be carried out in a laboratory where they may be compared with bacteria from related hosts. This problem is admirably summarised by Dowson (1958).

Current Problems

The origin and dissemination of new variants of Xanthomonas malvacearum and X. vasculorum in cotton and sugarcane growing countries, respectively, and their economic implications pose problems of great importance, especially in those territories which are financially dependent on one crop. It is for the bacteriologist to show whether strains of the bacterium with altered virulence for the host plant may be differentiated by laboratory techniques. In medicine, phage analysis has proved useful in the study of the epidemiology of staphylococcal and salmonella infections and the phage sensitivity test described by Crosse (1959) is one method of approach.

In general, as pointed out by Starr (1959) in his review, published accounts of new plant diseases caused by bacteria have contained inadequate descriptions of the causative organism, and there is a need for intensive study of phytopathogens,

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using the newer techniques by which bacteria of importance in medicine, veterinary science, or industrial bacteriology are delineated.

The study of host range is of fundamental and practical importance, because secondary hosts can act as reservoirs of infection. For instance, in Mauritius alternative hosts of the sugarcane gumming disease pathogen, Xanthomonas vasculorum, are too numerous to be eliminated, therefore complete reliance for control has to be placed on an intensive programme of breeding resistant varieties. In Queensland, bacterial mottle of sugarcane, caused by a soft rot bacterium for which there is not yet a full published description, has been recorded (Steindl, 1958) and several grasses in areas where the diseased sugarcane occurs have been shown to be naturally infected. Again, there is some evidence that the strain of Pseudomonas solanacearum attacking banana may survive on certain solanaceous weeds (Anon., 1958).

The factors affecting the capacity of different pathogens to infect a narrow or wide range of host plants are insufficiently understood, and more information on host/pathogen relationships is a prerequisite to improvement in control measures.

New Techniques

Apart from phage techniques (Crosse, 1959; Klement and Lovas, 1959) there are several comparatively new methods to be used in the study of bacterial plant pathogens. The technique of Hugh and Leifson (1953) is used in this laboratory together with the study of morphology and staining reactions in the initial process of differentiating bacteria from diseased material obtained on isolation plates. All discrete, morphologically distinct, colony types are inoculated by stab into duplicate tubes of a nutrient semi-solid medium containing glucose, one of which is left open, the other sealed with liquid paraffin or molten vaseline. Fermentative bacteria, which may be aerogenic or anaerogenic, metabolise carbohydrates under anaerobic conditions and thus produce acid throughout the depth of medium. Oxidative bacteria, by contrast, metabolise glucose under aerobic conditions alone and produce an indicator change at the surface of the medium. Thus the Gram-negative bacteria can be split up into several groups, and, for example, Erwinia lathyri separated from the yellow, oxidative bacteria, including Xanthomonas.

Carbohydrate Metabolism of Some Gram-Negative Rod-Shaped Bacteria from Plant Sources Using Hugh & Leifson's Method

FERMENTATIVE		OXIDATIVE
Aerogenic	Anaerogenic	
Erwinia carotovora	E. lathyri	Pseudomonas spp.
		e.g. P. solanacearum
E. atroseptica (some strains anaerogenic)	E. aroideae	P. syringae
		Xanthomonas spp.
		Agrobacterium tumefaciens

There are many apparently saprophytic oxidative bacteria, which are yellow in the mass on agar, that can be differentiated from Xanthomonas by intensive examination as shown by Dye (1959), using criteria other than plant pathogenicity. In this laboratory the techniques found most useful for this purpose include hydrolysis of starch, lipase by the Tween 80 method (Sierra, 1957), production of H_2S in a liquid medium containing cysteine, metabolism of specific hexoses, hexose alcohols, disaccharides and glycosides, hydrolysis of gelatin and casein, and maximum growth temperature.

Production of a green, diffusible, fluorescent pigment is characteristic of most

but not of all plant pathogenic pseudomonads, P. solanacearum, P. caryophylli and P. stizolobii being examples of those that apparently do not have this characteristic. King et al. (1954) and Paton (1959) have described what they claim to be improved methods for detecting pigment production in Pseudomonas.

The plant pathogenic bacteria related to the coliform group have not, so far as the writer is aware, been studied by the methods at present used by medical bacteriologists (see Cowan (1956) for references).

Functions of C.M.I. Bacteriology Department

At first the work will comprise:-

(1) Identification of bacteria from freshly collected diseased material sent by air to the Director, Commonwealth Mycological Institute, or identification of cultures of suspected plant pathogenicity.

(2) Maintenance for comparative purposes of authentic cultures of plant pathogenic bacteria, specializing in the first instance in those from Commonwealth tropical territories. Cultures will be deposited in the Ministry of Agriculture Collection of Plant Pathogenic Bacteria, at Harpenden, distribution of which is at the discretion of the curator.

(3) Research into new methods of identification.

At present facilities for plant inoculation are not available at C.M.I., but when a glasshouse is provided it will be possible not only to prove the pathogenicity of bacterial plant pathogens but also to investigate, albeit to an extent limited by the availability of space and host plants, the practical problem of host range.

Future objectives are the development of serological methods of identification and the foundation of a phage bank for service to Commonwealth countries.

REFERENCES

Anon. (1958), Problems and progress in banana disease research. Boston, Massachusetts, Dept. of Research, United Fruit Co., 1958. (R.A.M., 38, 156, 1959).

Cowan, S.T. (1956). Taxonomic rank of Enterobacteriaceae "Groups". J.GEN. MICROBIOL. 15, 345.

Crosse, J.E. (1959). Plant pathogenic bacteria and their phages. COMM. PHYTOPATH.NEWS, 5, 17.

Dowson, W.J. (1958). The present position of bacterial plant diseases. COMM. PHYTOPATH. NEWS, 4, 33.

Dye, D.W. (1959). The genus Xanthomonas. COMM. PHYTOPATH. NEWS, 5, 1.

Hugh, R. & Leifson, E. (1953). The taxonomic significance of fermentative versus oxidative metabolism of carbohydrates by various Gram-negative bacteria. J. BACT. 66, 24.

Kelman, A. (1953). The bacterial wilt caused by Pseudomonas solanacearum. TECH. BULL. N.C. AGRIC. EXP. STA. 99. (R.A.M., 32, 671, 1953.)

King, E.O., Ward, M.K., & Raney, D.E. (1954). Two simple media for the demonstration of pyocyanin and fluorescein. J. LAB. CLIN. MED. 44, 301.

Klement, Z. & Lovas, B. (1959). Isolation and characterisation of a bacteriophage for Corynebacterium flaccumfaciens. PHYTOPATHOLOGY 49, 107.

Paton, A.M. (1959). Enhancement of pigment production by Pseudomonas. NATURE, LOND. 184, 1254.

Sierra, G. (1957). A simple method for the detection of lipolytic activity of microorganisms and some observations on the influence of the contact between cells and fatty substrates. LEEUWENHOEK J. MICROBIOL. SEROL. 23, 15. (R.A.M. 37, 525, 1958.)

Starr, M.P. (1959). Bacteria as plant pathogens. ANNU. REV. MICROBIOL. 13, 211.

Steindl, D.R.L. (1957). "Bacterial Mottle", a new disease of sugar cane in Queensland. INT. SUG. J. 59, 174. (R.A.M., 37, 182, 1958.)

BRITISH MYCOLOGICAL SOCIETY

AUTUMN FORAY

The members of the British Mycological Society, who decided many months previously to hold this year's autumn foray in Glasgow, must have had uncanny second sight. Owing to the very dry summer few localities would have been suitable for the foray. Had we gone to Taunton this year instead of next as it is planned, we would have been lucky to find a single agaric, so scorched and dusty was the countryside in that part of England. To some of us, peering anxiously

Prof. Jørstad with some well-known members

(Photo by E.C. Large)

from the carriage windows of the Royal Scot as it set out from London, the country looked more like the plains of Eastern Africa in the dry season than England's green and pleasant land. The fields began to look greener, however, as we journeyed north-westwards and when the mountains of Cumberland appeared looking just a little moist, our spirits began to rise.

We had a foretaste of the excellent planning and organisation which Dr. Hutchinson, Dr. Hadley and his helpers from the Glasgow University had in store for us as soon as we stepped on to the platform on arrival. This was an announcement over the station's loudspeaker system telling us where to meet our hosts, and we were very soon being driven to Queen Margaret Hall and its annexes.

Our fears as to whether it had been wet enough for our quarries to make an appearance were not altogether allayed by the rather non-committal replies our queries evoked from our hosts. There were no doubts, however, about the care with which preparations for our visit had been made when we visited the Botanical Laboratory of Glasgow University that evening to inspect the maps of the localities we were to visit, and to hear of the arrangements which had been made for us. Considerable thought had obviously gone to the choosing of the excursions, so that we would see a range of different ecological communities. The accommodation for the eventual exhibition of our finds was vast and there was a good, large, separate workroom. Here the more enthusiastic members foregathered in the evenings during the foray. Derek Reid, van Eyndhoven, van Waveren, Henderson and others worked indefatigably on determinations and we owe them a great debt of thanks. E. C. Large could usually be seen in one corner, busy with photography and even developing his plates on the spot. Prof. P.H. Gregory was in another, building up a collection of slides of Basidiomycete spores for reference in his aerobiological work. We were pleased to welcome to the foray Professor Jørstad our guest of honour from Norway, Dr. E. van Eyndhoven, Dr. E. Kits Van Waveren, both from

Holland, and Dr. Handke from Eastern Germany. They gave the foray quite an international atmosphere.

The first expedition which was to Dougleston Woods, Milngavie, went far to allaying our fears as to the effects of the dry summer and quite a goodly bag of agarics was obtained. There were, in fact, plenty of macrofungi to be found on all but one of the excursions. How those interested in other groups fared, I do not know, but I understand Prof. Jørstad made a considerable collection of rusts.

On our second day, we visited Balloch Park at the Southern end of Loch Lomond and found this a very rich hunting ground. We lunched by Balloch Castle, when Large was seen to be very busy documenting the foray with his camera. Some admirable shots of mycologists at large resulted. In the afternoon, we motored up the side of Loch Lomond to Rossdhu House, Luss, where some more good collecting was to be had. On the return trip, we continued up the Loch to Arrochar and then down the sea lochs, Loch Long and the Gare Loch. This was a very beautiful trip in spite of some suggestions of sea sickness produced by the switchback road.

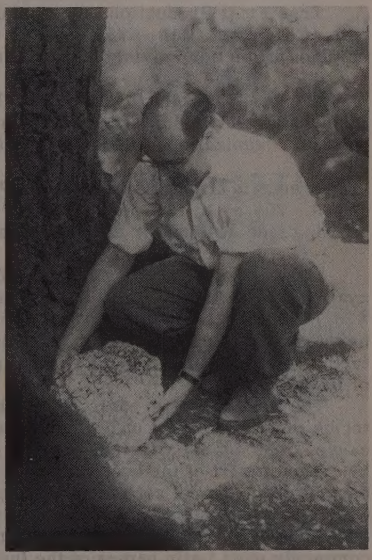
Saturday was a free day, but as so often happens, many went on collecting excursions. Two of us, Derek Reid and myself, climbed Ben Lomond at the suggestion of Dr. Hutchinson, to see what agarics we could find above the tree line. There were very few indeed, for the mountain was astonishingly dry.

On Sunday afternoon, we visited Flanders Moss, a raised peat bog with lag woodlands. The agarics were not abundant, but in compensation some interesting species were found.

The next day there was an excursion to the Scottish Mushroom Laboratories, which was very interesting; however, only one species of agaric was seen! It was a pity the staff were not at work, so that we could get a clearer picture of how things were done. Cadzow Park in the afternoon was beautiful but too dry for much collecting. In the evening, there was a convivial Annual Dinner in the College Club of the University following a reception by the Court of the University. It was complete with speeches and a piper, and we duly turned our thoughts to the memory of past mycologists during the playing of the Piobaireachd.

On the last day there was a very fine excursion to the Ben More Botanical Gardens, including a trip across the Firth of Clyde. We were all up at an early hour so as to give the maximum time on Ben More. It was a little dampening to our ardour, therefore, when the coach to take us to the station arrived late. Then, as it set out, it stuck, because of its enormous length, as it turned on to the main road. After much manoeuvering, it eventually continued its journey. In spite of a mad charge down Glasgow Station, we arrived just in time to see the train departing. Luckily there was another train and boat a little later and nothing much appears to have been lost as we had ample time at Ben More. Apart from this one excursion, the arrangements for the foray went extremely smoothly and we owe a large vote of thanks to our hosts for their great skill in organisation. It was altogether a most delightful and memorable foray.

R.W. Rayner



Derek Reid with Sparassis crispa.
(Photo by E.C. Large)

FROM NEAR AND FAR

Of the $350 m. spent on scientific research in American universities and colleges during the year 1953-4, over $74 m. went to agricultural experimental stations (SCIENTIFIC RESEARCH AND DEVELOPMENT IN COLLEGES AND UNIVERSITIES: EXPENDITURE AND MANPOWER 1953-54. pp. iii + 173. Washington, D.C.: Government Printing Office, 1959. $1.0).

The National Science Foundation of the United States has made 14 grants totalling just over $1\frac{1}{2}$ m. dollars to provide scientific personnel and improved and specialized equipment to about a dozen institutions in that country.

Those readers who are interested in botanic gardens will find an excellent summarized history of the famous Botanic Gardens of Singapore, written by H. M. Burkill, the present director, in NATURE, LOND. of 21 November 1959.

B. D. Harrison and C. H. Cadman have shown (NATURE, LOND. 184: 1624) that arabis mosaic virus, which is implicated in several diseases of white clover, raspberry, and strawberry, and also, possibly, in rasp leaf-type cherry diseases, is transmitted by dagger nematodes (Xiphinema sp.).

Progress in control of cereal root rots will be examined at an Interstate Conference to be held in April, 1960, at the Wagga Agricultural Research Institute and Wagga Agricultural College, Australia.

In a reorganization of the Shell Chemical Co. Ltd., the Agricultural Division remains unchanged and continues under the management of Mr. H. G. Huckle.

Publications of Interest

Tree Fruit Production, Shoemaker & Teskey, (N.Y. John Wiley & Sons. London. Chapman & Hall, 1959. 56s.). General instructions for students with a section on plant protection, mainly horticultural.

World of Learning 9th Ed. 1958 (London. Europa Publications Ltd., 130s.). Includes Unesco and International Convention of Scientific Unions, and other international organizations. Index of institutions, but not persons.

Trends in Genetic Analysis, G. Pontecorvo. (London, Oxford University Press. 25s.: N.Y. Columbia Univ. Press, 1959.) Mainly for geneticists but exciting side reading for all biologists.

Maladies of Hevea in Malaya. (101 pp., 41 col. pl., Rubber Res. Inst., Malaya, 1959. $30 (Malayan); in countries contributing to the Malayan Rubber Fund, $20.) by R.N. Hilton aims to help the planter to identify the pathological conditions he encounters by means of carefully prepared descriptions and illustrations. A further aim is to indicate the general principles governing the control of diseases of Hevea rubber.

The work is in two parts. An introduction (pp. 11-17) covers in general terms the six headings under which each disease is later dealt with: symptoms, cause, other plants affected, spread, prevention, and treatment. This is followed by the main part of the book, which illustrates and describes 41 maladies and abnormal conditions of rubber as they appear in Malaya, the names of the diseases being given in English and Malay. In view of the purpose of the work, it has not been considered necessary to adhere to a strict, nomenclatural discipline, the commonly used Latin names of the fungi being used. The main sections cover diseases of the whole plant; the root; the stem and branches; the tapping panel; the leaf of the young plant; the growing leaf; and the leaf of the mature plant.

Parasitic diseases covered include white (Fomes lignosus), red (Ganoderma pseudoferreum), and brown (Fomes noxius) root diseases and root rot (Ustilina

zonata), die-back (Gloeosporium albo-rubrum), thread blight (chiefly Marasmius cyphella), and pink disease (Corticium salmonicolor). Attention is also given to black stripe (Phytophthora palmivora), and mouldy rot (Ceratocystis fimbriata) of the tapping panel.

An important feature of the book is the excellent watercolours by Hoh Choo Chuan, which are of quite exceptional merit.

This is a book to enhance the value and décor of any plant pathology library.

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Association of Applied Bacteriologists 1959-60

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Royal Society

Among the elected Council members for 1960 of the Royal Society is Professor T.M. Harris, professor of botany, University of Reading.

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PERSONAL NEWS

C.M.I. News

The Director spent six weeks after the International Botanical Congress visiting the recently reorganized Canada Agricultural Research centres and returned to C.M.I. early in October.

G.F. Laundon B.Sc., has been appointed assistant mycologist and commenced duty on 1 October, 1959.

K. Pirozynski B.Sc. has come from Bristol to work temporarily in the Herbarium.

Visitors

A party of 25 students and staff from the Brunel College of Technology visited the Institute in December.

Visitors to the C.M.I. have included P.S. Davies, S.Africa; R.N. Hilton, R.R.I., Malaya; Dr. Frances Keddie, Los Angeles, U.S.A.; D.McDonald, Northern Nigeria; S.A. Nashef, Jordan; Dr. Hermano Neves, Portugal; M.M. Pellitier, S.Africa; Dr. Ahalya Rao, India; G. Brian Wills, Ghana.

Appointments, Promotions, Retirements, etc.

The Overseas Service Division of the Colonial Office announce the following appointments: K.B. Bock, senior scientific officer, I.D. Firman, plant pathologist, and I.A.S. Gibson, principal scientific officer, Kenya; N.B. Flockhart, assistant director of agriculture (extension), Sarawak; S.D. Hocombe, botanist, Tanganyika; M.R.L. Johnston, entomologist, Northern Region, Nigeria; R.J. Spooner, assistant director of agriculture, Tanganyika; J. Strangways-Dixon, entomologist, British Honduras.

Mr. A. Perera, representing Ceylon, has been elected chairman of the Executive Council of C.A.B. in succession to Dr.J.G. Malloch M.B.E. Mr. C.K. Raheem, the representative of Pakistan, has succeeded Mr. Perera as vice-chairman.

Dr. H.R. Barnell has been appointed chief scientific adviser to the Ministry of Agriculture, Fisheries, and Food in succession to Dr. N.C. Wright, who has become director-general of F.A.O.

A Nomenclature Committee for Fungi and Lichens was elected at the 9th International Botanical Congress held in Montreal last August, with M. Le Gall (France) as chairman and M.A. Donk (Netherlands) secretary. F.C. Deighton of C.M.I. was elected a member to represent Gt. Britain.

Dr. J.H. Western has been appointed to the newly instituted chair of Agricultural Botany at the University of Leeds.

Dr. J.T. Martin has been appointed reader in chemistry of insecticides and fungicides in the University of Bristol, and Dr. M. Woodbine to a readership in agricultural microbiology at Nottingham.

Dr. J.M. Thoday of University College of North Wales has been appointed to the Arthur Balfour chair of genetics at the University of Cambridge.

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OVERSEAS NEWS

CANADA

From 1954 to 1959, Dr. Skoropad, formerly of the Plant Pathology Laboratory, Canada Department of Agriculture, at Edmonton, Alta., and now on the staff of the Plant Science Department, University of Alberta, has been studying barley scald, the most important foliage disease of the crop in central and northern Alberta. He has briefly summarized the results of his investigations in an article which will appear in the April issue.

AUSTRALIA

Potato race 4 of Phytophthora infestans in Australia

R. J. Conroy reports that previous to 1959 isolates of the potato late blight pathogen in New South Wales have been race 0 on the International Classification. An isolate obtained in July, 1959, from Warriewood in the Sydney Metropolitan Area, when inoculated to a differential series of seedlings produced a fully susceptible reaction on seedling 1563c(14) but a hypersensitive reaction on seedlings containing genes R_1, R_2, or R_3. The isolate was thus identified as race 4.

Seedlings containing gene R_4 have never been grown within some hundreds of miles of Warriewood and it would appear that the race 4 has arisen there by mutation from the common race 0. Recently Gallegly and Eichenmuller (AMERICAN POTATO JOURNAL 36: 45, 1959) have drawn attention to the widespread occurrence of race 4 even in areas where varieties containing gene R_4 have not been grown. As a result of experiments they have postulated that the ready changing of other races to include the race 4 characteristic "could be due to mutation of nuclei within the thalli with the mutant nuclei being carried in heterocaryotic mycelium along with the original nuclei".

From the viewpoint of breeding for immunity to late blight in potatoes it is obvious that seedlings or varieties containing gene R_4 alone should not be used as parental material.

Barley Yellow Dwarf

The occurrence of cereal [barley] yellow dwarf virus disease in Australia was first reported by Smith (C.P. NEWS 3: 10, 1957) following a brief visit to Tamworth, N.S.W., in 1956. Identification was made on the basis of symptoms only.

During 1959 confirmation of the presence of the disease has been obtained by F.C. Butler, N.E. Grylls, and D.J. Goodchild working at the Wagga Agricultural Research Institute and in Canberra. Transmission has been obtained with the aphids Rhopalosiphum padi, R. maidis and Macrosiphum avenae s. sp. miscanthi, symptoms in field and experimental plants being typical of those described by earlier workers. All mechanical transmission tests were negative. R. padi was the species most commonly encountered in the field on cereals, and on barley grass (Hordeum leporinum) and Wimmere ryegrass (Lolium rigidum).

As yet barley yellow dwarf virus has caused minor crop losses only in New South Wales.

Subterranean Clover Stunt

Subterranean clover stunt, a virus disease first observed in N.S.W. in 1955, is now widespread in southern Australia. Symptoms include stunting, marginal chlorosis, puckering of young leaflets, and a crimson or purplish colouration of the older leaves, symptom expression varying with the variety and environmental conditions.

The disease has been very conspicuous on the N.S.W. coast this year, whole paddocks turning crimson in some instances, and has possibly been more prevalent than in any year since that in which it was first observed.

N.E. Grylls of the C.S.I.R.O. and F.C. Butler of the Wagga Agricultural Research Institute have shown the virus to be aphid transmitted and of the persis-

tent type. It has not been transmitted mechanically and no evidence of seed transmission has been obtained. The host range covers a wide variety of legumes, including some tropical species.

Subterranean clover is a winter-growing annual and the means by which the disease is carried over from season to season has not been determined, but the virus probably persists in summer-growing annual and perennial legumes.

Black Cob-Rot of Maize

P. G. Valder reports the occurrence of Helminthosporium carbonum on maize for the first time in New South Wales. It was found causing a black cob-rot of a single cross and its component inbreds. Subsequently it was shown experimentally that all of a number of inbreds and hybrids were susceptible in the seedling stage but it is hoped that, as in the case of H. turcicum, resistance will be found if older plants are used and that, as has been found in the United States, susceptibility will prove to be the exception rather than the rule.

Taphrina on Apricots

A disease of young apricot shoots producing a witches broom effect and caused by a species of Taphrina has been known in N.S.W. since 1914. This disease has been attributed to T. deformans (Berk.) Tul. Recently J. Walker has reported that comparison of the Taphrina on apricot with that causing peach leaf curl showed that the asci of the apricot fungus are much shorter than those of the peach fungus. The asci from apricot measured 15-25 × 6-10 μ whilst those from peach measured 20-45 × 6-10 μ. These measurements do not include the foot cell, which was present in both cases.

Examination of the literature shows that there is considerable doubt about the identity of the fungus on apricot. Mix, in his monograph of the genus Taphrina (UNIV. KANSAS SCI. BULL. 33(1): 1-169, 1949) lists two species on apricot, T. mume Nishida, causing leaf curl and hypertrophy of twigs in China and Japan, and T. armeniacae Georgescu and Badea, causing witches' brooms in Rumania, and only lists peach and close peach relatives as hosts of T. deformans. Anderson (DISEASES OF FRUIT CROPS, McGraw Hill, 1956) states that the apricot is immune to T. deformans.

In view of the differences in morphology and in symptoms produced, it appears quite possible that the fungus on apricot is not T. deformans. Reciprocal cross-inoculations and examination of symptoms and morphology of each fungus on each host would help in sorting out this point.

C. J. Magee

NEW ZEALAND

Immunity to Club-root Disease in Swede

A swede variety widely grown in New Zealand has proved to be immune from club root infection in all localities where it has been grown. There is no reference to highly resistant or immune swede varieties in a recent publication on club root by John Colhoun (PHYTOPATH. PAP. 3, C.M.I., Kew) so it was thought that greater publicity should be given to the existence of this variety in N. Z. The swede is white fleshed, with a purple top and tendency to have a "peg" root on one side. It is also highly resistant to cauliflower mosaic in the field but has moderately high susceptibility to dry rot, Leptosphaeria maculans. This swede was identified by the letter 'Y' in early trials and has thus been named Wye swede, although it has no English associations. Mr. Wallace of the N. Z. Department of Agriculture made the original selections in some material which is thought to be of Canadian origin. The Wye swede is popular in N. Z. because it can be grown as a second swede crop without suffering from club root. Second crops, however, are often severely attacked by dry rot disease originating from the residue of the previous crop, and all reports of the "breakdown" in clubroot resistance in this

country have been found to be caused by dry rot disease.

Wye swede is one of the main parents in the present N. Z. breeding programme aimed at introducing club root, cauliflower mosaic, and dry rot resistance into swede varieties. This work is at present reaching an advanced stage and a number of promising lines will be field tested this coming season.

The perfect Stage of Phoma betae

As a follow up of the recognition of the perfect stage of Phoma lingam I decided in September 1957 to try to find the perfect stage of Phoma betae which had been first recorded by Bjørling (BOT. NAT. ser. 218, 1944) as Pleospora betae.

Some silver beet plants growing in a home garden were found to be infected with Phoma betae. These plants were allowed to seed during the summer of 1957-8 and the old seed stalks were laid on the soil surface until early summer 1958-9. These stems were then brought in to the laboratory and examined for perithecia.

Black, hemisphaerial perithecia averaging 300μ in diameter were found in abundance among pycnidia of the same fungus.

Ascospores averaging 19 × 8μ were dark in colour with usually one vertical and three transverse septa. They were readily discharged from moistened perithecia on to agar plates and single spore isolations developed into cultures with abundant pycnidia and spores typical of Phoma betae Frank. Inoculations showed that these cultures from ascospores were as pathogenic as those from the pycnidial stage when reinoculated into beet roots.

These observations confirm other work at Lincoln, England, where Dr. Cornford found the perithecia of Pleospora betae and C. M. I. isolated the pycnidial state (Phoma betae) from ascospores (C. P. NEWS 5: 11).

It is pleasing to note that the REVIEW OF APPLIED MYCOLOGY has now decided to recognise Bjørling's work and to refer to Pleospora betae Bjørling as the pathogen rather than to Phoma betae Frank.

It is quite apparent from this example and other recent investigations, such as that on Septoria blight of oats (C. P. NEWS 3: 57), that in the case of most fungi causing plant disease there is an unnatural reluctance to retain the name of the imperfect stage for an unnecessarily long time after the discovery of the perfect stage.

Harvey C. Smith

Dry Rot of Brassicas

How important is seed infection? H. C. Smith has shown that dry rot might be spread by means of ascospores originating from old crop residues on which the perithecia of Leptosphaeria maculans, the perfect stage of Phoma lingam, are found (N. Z. SCIENCE REV. 14: 116-117, 1956). This was good news to those workers who had come across many anomalies in the textbook story of the development of dry rot from infected brassica seed. It explained, for instance, the inevitable appearance of the disease in a field out of pasture, sown with hot water-treated seed. Facts such as this, and the greater severity of the disease in second crops, caused Hughes to question the importance of seed infection as long ago as 1933 (SCIENT. PROC. ROY. DUBLIN SOC. N. S. XX: 495-530, 1933). Until the discovery of the wind-blown ascospores, however, it was difficult to ascribe the long-range spread of the disease to any agent other than the seed.

Recent work in New Zealand has been aimed at determining the relative importance of seed-borne and wind-borne spores in the initiation of the disease, and field trials to this end were laid down in the main swede-growing areas of Otago and Southland last season. These trials were of two types. In the first different swede lines with known levels of dry rot infection were sown. The infection varied from nil to 0·3 per cent, the latter being the most severely infected seed lines available. In addition, an artificially inoculated line with an infection of 3·0 per cent. was included. By comparing these initial levels of seed infection with the subsequent incidence of dry rot in the crop it was possible to establish the relation-

ship between them. The second type of trial was concerned chiefly with the control of dry rot by seed treatment, but the treatments chosen were tested on a naturally-infected line with 0·1 per cent. infection and an inoculated line with an infection of over 6·0 per cent.

The results of the first group of trials showed no differences between treatments although the total bulb infection in June was as high as 11 per cent. in one case. In the second group the seed treatments reduced the amount of dry rot only in those plots sown with inoculated seed.

All in all, it was obvious that under the dry conditions pertaining in Otago and Southland last season, natural seed infection had no noticeable effect on the development of the disease. Even with inoculated seed the effect was not consistent, although the degree of seed infection was much higher than would ever be found under natural conditions. It is possible that the dry spring weather was partly responsible for the failure of the fungus to spread from the seed to the developing seedlings. Even allowing for this, however, it appears that seed-borne infection by "Phoma lingam" is of little consequence compared with that originating from Leptosphaeria maculans on old crop residues.

J.D. Allen

INDIA

Red Rot of Sugarcane

This is the most important disease of standing cane in India, being responsible for heavy losses to the crop annually. It has been proved at the Indian Agricultural Research Institute, New Delhi that light coloured, highly sporulating strains of the fungus (Glomerella tucumanensis (Speg.) Mueller Arx) are more virulent than dark, lightly sporulating strains. Experiments conducted during the last four years have shown that a mixture of light and dark strains gives better infection in most varieties than a mixture of two light, two dark, or individual strains.

Studies on the germination of conidia of the causal organism show that aeration of the substrate has greater influence on the germination of light than of dark type strains. A technique to induce better germination in light type strains has been developed by limiting the depth, area, and volume of the germination drop on the slide, and also the concentration of spores per unit area.

Viruses

Schizaphis graminum Rond has been shown to be an additional vector of sugarcane mosaic virus, whilst Rhopalosiphum (Aphis) maidis Fitch and Longiunguis idiosacchari have been found to be additional vectors of grassy shoot of sugarcane. The latter virus has been successfully transmitted to jowar (Sorghum vulgare), Napiergrass (Pennisetum purpureum), and Pennisetum ciliaris.

Electron micrographs of purified virus preparations of bottlegourd (Lagenaria siceraria) mosaic (cucumber green mottle mosaic) virus show that the particles are rod shaped, average size being 800 × 25 mμ.

R.S. Vasudeva

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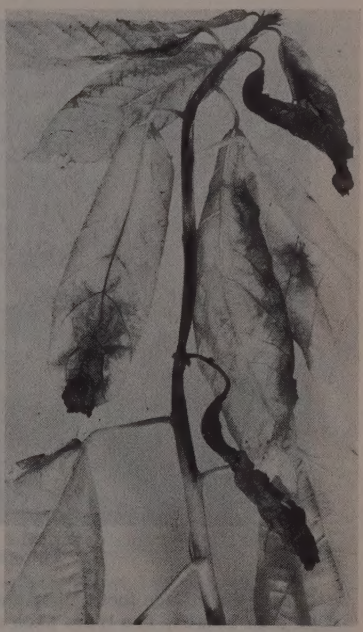
GHANA

PHYTOPHTHORA PALMIVORA causing a leaf and stem blight of cocoa

In June, 1959, a leaf blight and die-back of chupons was found on cocoa trees on a farm on the Mpraeso scarp in Southern Ghana. The scarp is enveloped in low cloud for much of the year and because of these conditions the farm had been virtually abandoned owing to an almost complete loss of crop by black-pod disease (Phytophthora palmivora).

A Phytophthora sp. sporulated freely from diseased leaf and chupon material collected from this site and kept overnight in humid chambers. The fungus was isolated easily on to oatmeal agar from both stem and leaf. Zoospore suspensions of the isolates readily infected unhardened flush leaves when sprayed on to seedlings, the disease symptoms usually appearing within two days.

Our photograph shows natural infection of a chupon and young leaves. Fresh chupon infections superficially resemble Mirid damage, but differ in that the chocolate-brown lesions are not sunken and the necrosis spreads more rapidly and extensively in the young stem tissue. All attempts to infect hardened tissue have failed and natural infections are apparently confined to young leaves and stems. As the tissues mature, further spread of the fungus is checked and the infection dies out. However, young seedlings before the second leaf flush stage can be killed if infection destroys the apical growing point and spreads down to the cotyledon axillary buds before the stem hardens.



Phytophthora palmivora attacking young chupon and leaves of Amelonado cocoa. Bunso, Ghana.

During a visit to the Southern Cameroons in 1957, Wharton (1) found a Phytophthora associated with an extensive tip necrosis of leaves on mature cocoa trees, and in 1959 Turner isolated Phytophthora from diseased leaves and chupons in Nigeria, Southern Cameroons, and Fernando Po. Wharton (1) also demonstrated a Phytophthora to be the cause of a blight of four-week old Amazon seedlings in a cocoa nursery in Ghana, the symptoms being identical with those described by Chant (2) for cocoa seedling die-back in Nigeria. Chant's isolates were only identified provisionally as P. palmivora by the Commonwealth Mycological Institute; from comparative tests on strains of P. palmivora occurring in West Africa, we consider our Ghanaian leaf and chupon isolates to be identical with the strain of P. palmivora commonly attacking cocoa pods in this country.

All types of damage to cocoa for which P. palmivora is responsible (pod rot, bark and cushion canker, leaf blight and stem die-back) have now been confirmed in Ghana.

REFERENCES

(1) Wharton, A. L. (1959). ANN. REP. W. AFR. COCOA RES. INST., 1957-1958, p. 29.
(2) Chant, S. R. (1959). TROP. AGRICULTURE, TRIN., 36: 138-144.

A. C. Wharton
P. D. Turner

W. A. C. R. I., Tafo.

NIGERIA

A GIANT MUSHROOM AT UMUOZUO VILLAGE NEAR ABA

With the company of the Agricultural Supervisor at Aba, I visited the village and had easy access to the spot where the mushroom existed. It is approximately

The giant of Umuozuo

8 ft. from the village foot path and about 100 ft. from a motor road. The mushroom grew between two trees each of about 40 years old. A very thick deposit of old leaves is noticeable and at the base of each tree termite mounds could be found. This patch of land has not been cropped for many years, but Piper nigrum grows there abundantly.

The story goes that in December, a fairly large mushroom was spotted by a small boy. This was dug out after a week and was left at the side of a motor road close by. But about 2 weeks later, another mushroom emerged at the very spot. This giant mushroom was 3 ft. high and $5\frac{1}{2}$ ft. in diameter. The upper surface was dark purple in colour and on it was another large mushroom. The lower surface and the stem were white in colour. A blood-like stain on the hands of those who touched the upper surface did not come off for about 3 days, and all attempts to remove the stains on clothes failed, even with the use of milton.

However, the villagers got worried and most of them deserted their homes. The chiefs called in the native doctors to remove and bury it somewhere and somehow so that such should never re-occur in the village.

I visited a chief living about 50 yards close by with the main object of knowing exactly how and where they disposed of the mushroom. He said that as there was an influx of strangers in the village for the sake of this mushroom he ordered the youths to dig it and put in a latrine hole. This was a well dressed story in defence of the fact that they deserted the village and invited the native priests to perform the burial ceremony. My attempts therefore to lay hands on the remains of the giant mushroom became abortive.

I took photograph of the bush, and collected soil sample at the foot where the mushroom grew. Also, I collected the remains of the first mushroom which was placed by the side of the road.

I went into Aba township in search of photographs of the mushroom and was lucky to purchase 8 half-plate copies (for 16/-) showing: (a) the upper surface (b) the side view when placed on a tree stump. Unfortunately, I could not lay hands on a picture with the standing position of the mushroom.

Dr. R.H. Cammack of the Maize Research is in possession of a set of the photographs and the specimens. The soil sample is in E6 Kola plot and will be observed regularly for any possible emergence of mushroom in due course.

J. Ekanden

[*Editorial Note:* Dr. Cammack has forwarded this rather delightful story together with the accompanying photo. To descend to the prosaic level of scientific fact, Mr. Deighton says he had several collections of what is apparently the same fungus, but not as large, in Sierra Leone and it was tentatively identified as Polyporus mesotalpae Lloyd. Cammack confirms the diameter of the pileus as being 5 ft. 6 ins. and the length of the stipe as 2 ft. 6 in. He also adds that nothing grew from the mycelium which was seeded at Moor Plantation. We hope it will never be responsible for the evacuation of the research staff!]

IMPORTANT NAME CHANGES IN HERB.I.M.I., 1959

Angiopsora ampelopsidis (Diet. & Holw.) Thirum. & Kern = Physopella ampelopsidis (Diet. & Holw.) Cumm. & Ramachar

Angiopsora zeae Mains = Physopella zeae (Mains) Cumm. & Ramachar

Cercospora juniperina Georgescu & Badea = Stigmina juniperina (Georg. & Badea) M.B. Ellis

Cercospora mangiferae Koord. = Stigmina mangiferae (Koord.) M.B. Ellis

Clasterosporium carpophilum (Lév.) Aderhold = Stigmina carpophila (Lév.) M.B. Ellis

Clasterosporium glomerulosum (Sacc.) Sacc. = Stigmina glomerulosa (Sacc.) Hughes

Exosporium deflectens Karst. = Stigmina deflectens (Karst.) M.B. Ellis

Puccinia bromina Eriks.
Puccinia dispersa Eriks. & Henn.
Puccinia rubigo-vera Wint.
Puccinia triseti Eriks.
Puccinia triticina Eriks.
= Puccinia recondita Rob. ex Desm.

Puccinia fagopyri Barclay (non Haszl.) = Puccinia fagopyricola Jørstad

Puccinia glumarum (Schm.) Eriks. & Henn. = Puccinia striiformis West.

Pucciniopsis anacardii Syd. = Stigmina anacardii (Syd.) M.B. Ellis

Uromyces alopecuri Seym. = Uromyces dactylidis Otth

Uromyces fabae (Grev.) De Bary ex Cooke = Uromyces viciae-fabae (Pers.) Schroet.

Amongst the name changes listed are two transfers from the genus Clasterosporium to the genus Stigmina which are of special interest to plant pathologists who may wish to know the reason for the transfers.

In the type species of Clasterosporium, C. caricinum Schweinitz, the colonies are black, velvety, effused, often covering the whole width of the abaxial surface of a leaf base and up to 24 cm. long. The mycelium is superficial, hyphopodiate, composed of a repent network of branched and anastomosing hyphae. A pale spot in the centre of each hyphopodium indicates the point of emergence of a very thin strand of mycelium which penetrates the cuticle of the leaf to form a haustorium in the epidermal cell below. Dark, thick-walled setae up to 460 μ long arise laterally on the hyphae in old colonies. The dark brown conidiophores also arise laterally on the hyphae. The conidia, which are brown phragmospores, are formed singly as blown-out ends at the tips of the conidiophores. This is illustrated in Mycological Paper No. 70.

The only taxonomically important character which the pathogens Clasterosporium carpophilum and Clasterosporium glomerulosum have in common with the type species of Clasterosporium is the possession of phragmospores formed as blown-out ends at the tips of the conidiophores. The colonies of the pathogens are punctiform, not effused; their mycelium is immersed, not superficial, and is non-hyphopodiate. There are no setae. The conidiophores develop close together from the upper cells of a stroma, not spaced out as lateral branches on the mycelium. In fact, they do not fit the genus Clasterosporium.

C. carpophilum and C. glomerulosum are better classified in the genus Stigmina in which the colonies are nearly always punctiform, the mycelium is non-hyphopodiate and immersed, the conidiophores short, closely packed together, arising from the upper cells of stromata, and the conidia formed singly as blown-out ends at the apex of the conidiophore and successive proliferations. A full illustrated account of the genus Stigmina is given in Mycological Paper No. 72.

Comments from mycologists will be welcome.

DISTRIBUTION MAPS OF PLANT DISEASES

The part you can play

The attention of readers of C.P. NEWS is drawn to the help that they can give towards increasing the accuracy of the C.M.I. Maps. A new map is made by consulting all the indexes of backnumbers of R.A.M. for references to the pathogen, and, in addition, searching a large number of standard lists of fungi occurring in different parts of the world. Maps are kept up-to-date by making a note of any mapped pathogen mentioned in an abstract, in new disease lists, or in correspondence received at the Institute, and a list of such additions is published annually. With the present large number of issued maps, however, it is not difficult, despite a comprehensive index, to overlook the fact that a pathogen has been mapped, so a revised list of corrigenda and addenda for the first 350 maps is to be published shortly, after checking through all R.A.M. indexes since the last edition of each map was published. Errors can also arise if a published record of a disease in any area has been based on symptom observation only without proper identification of the pathogen, or owing to pitfalls of synonymy: really doubtful records are, of course, queried in the maps.

In other cases, the known distribution of a disease in several scattered areas of a large region, e.g. the countries of Europe, makes it probable that a pathogen may occur in intermediate areas although no authentic record thereform may have been published. In both these instances the information may not have reached the C.M.I.

The Director is always grateful, therefore, to receive information concerning the accuracy of existing map records and of additions or deletions that should be noted and incorporated in subsequent editions of maps.

OBITUARY

It is with regret that the deaths of three leading personages in the world of agriculture are announced, namely,

J.C. May, director of the Empire Cotton Growing Corporation in September, Professor E.S. Salmon, whose classical work on the Erisyphaceae is part of the basic training of all plant pathologists, and Professor M. Caffrey, who held the Chair of Plant Breeding at the National University of Ireland since 1938, and devoted most of his life to breeding for resistance to disease in cereals and grasse

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